

The Use of Productivity Improvement Tools and Techniques in the Botswana Textile Industry

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Abstract— The Botswana textile industry is surrounded by major competitive pressures from foreign markets which make locally produced products to perform poorly. Failure to be competitive is due to poor quality of local textile products as well as high production cost as a result of poor operational efficiencies characterising the country's textile industry. As a result most of the local customers tend to buy foreign produced goods or imports instead of buying locally made products, hence squeezing the local textile companies out of the market. The competitive pressure from foreign goods has led some textiles companies to close down, leaving thousands of people jobless. The aim of this study is to investigate the use and impact of key productivity improvement tools and techniques within the Botswana textile industry. Results indicate that the knowledge of productivity improvement tools depends on company size, with large companies having the most knowledge. Also, a lot of tools are used, but companies find most of the tools not to be useful, which may indicate problems with poor implementation of the tools.

Keywords— Productivity improvement, textile industry and clothing, lean manufacturing, Botswana.

I. INTRODUCTION

THE textile and clothing industry in Botswana is an important contributor to economic activity, employing over 6,000 workers and generating export sales of over US\$172 million in 2011[1]. The employment rate under this sector still remain high after the 2009 recession as compared to other manufacturing sub-sectors like agriculture. The sector was identified by government as one of the Economic Diversification Drive (EDD) priority sectors that can contribute to economic diversification, in view of its employment creation capacity for semi-skilled labour, which alleviates poverty especially for women, and generate significant export revenue [1]. The Botswana textile industry is

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therefore a key manufacturing sub-sector with the potential to contribute significantly to the economy's diversification, thereby supporting the country's growth objectives. However, the contribution of the textile sub-sector to the economy is significantly hampered by its lack of competitiveness due to poor factory efficiencies [2].

The poor competitiveness of the sector is brought by poor implementation of productivity improvement tools, resulting in poor operational efficiencies, which lead to poor quality of textile products [2]. According to the Local Enterprise Authority, the quality of goods and services entering the market is poor, since many industries do not implement the correct standards to promote the quality of goods and services [3]. As a result, most of the local customers tend to buy foreign goods or imports instead of buying locally made products, hence squeezing the local textile companies out of the market.

The demand from customers for increased competitiveness has resulted in the need for business improvement in the textile industry. Terms like 'lean' and 'continuous improvement' are now used in all areas of business as the textile companies try to find areas of improvement. The sector is experiencing continuous changes with greater weight being placed on the industry to deliver higher quality goods at lower cost. The introduction of these changes has established the situation whereby a multitude of productivity improvement tools and management methodologies are now being used within the sector, to help them to meet improvements they need, but the success so far is very limited.

The challenges facing the sector need to be investigated so that ways of helping the industry to improve its productivity can be explored. To this end, the purpose of this study is to investigate the use and impact of productivity improvement tools in the Botswana textile industry. This will provide an assessment of application, impact and analysis of factors that are hindering the effective application of productivity improvement tools in the sector. The objectives of the study are as follows:

1. To assess the level of application of productivity improvement tools within the Botswana Textile industry,
2. To investigate the impact of the use of productivity improvement tools within textile industry,
3. To investigate challenges faced by the textile industry in applying productivity improvement tools,

The rest of the paper is structured thus: The next section presents the literature review. Section III provides the methodology. Section IV presents the results from the study and their discussions. Finally, conclusions are presented in Section V.

II. LITERATURE REVIEW

A. Productivity

Productivity is a very important measure in manufacturing operations, besides turnover and profit, because it provides insight into the efficiency and effectiveness of operations [4]. Productivity is the effectiveness and efficiency with which a firm converts inputs into outputs: that is, a measure of the effectiveness and efficiency of an organisation in generating output with the resources available. In improving the productivity of a company, the business will gain many benefits, which ultimately results in increased profitability of the organisation.

Productivity changes can be caused by either movements in the 'best practice' of production technology, or a change in the level of efficiency [5]. Improved productivity will have a positive impact on the direct costs of products, as the same output is produced with less input or as the same inputs are producing more output. This can create new opportunities and improve the competitiveness of an organisation. Grünberg [6] (2003) mentioned that efforts to improve manufacturing productivity have been on since the start of industrial era. Some of the first known and well-documented practitioners in the area of productivity improvement were Adam Smith (1776), Henry Fayol (1916), Frank and Lillian Gilbreth (1917), and Henry Ford (1926) [6]. Examples of some key productivity improvement tools being used in industry includes lean, Just-in-time, 5S, standardised work, value analysis, Pareto analysis, cause-effect diagrams, cost/benefit analysis, continuous flow, Heijunka, Jidoka, etc. Since the 1950s, competition between companies has increased as markets have become increasingly global, and there are no signs that this competition will ease. This increased competition creates an even greater need for first-rate improvement methods that can sustain competitiveness.

B. Productivity in the Botswana Textile Industry

The research carried out by the Botswana Export and Development Authority (BEDIA) on the Botswana textile and apparel industry found that the levels of productivity within the garment manufacturing and textile industry were low with the best examples estimated to be 50% of the established international standards [2]. The underlying reasons for these poor levels of performance were identified as inadequately trained operators and lack of control by supervisory management, resulting in production output and quality targets not being met. Since 2004, thousands of workers have been losing jobs as companies retrench to cut operating costs, until in December 2009 when government approved short term measures to improve the competitiveness of the textile and clothing industry in order to retain jobs in the sector [7]. Government approved a stimulus package for the textile

industry in December 2009, which was to be implemented during early 2010 to rescue the sector. More so, the industry also faces tough competition from India and China who have an advantage of low-cost labour and efficient operations [1]. Despite the stimulus package, the productivity of the sector still failed to increase as expected. The Botswana National Productivity Centre (BNPC) report of 2011 stated that local textile products are failing to compete with imported goods since local companies use simple tools in improving productivity which fail to deliver expected improvements [7].

Allen et al, [8] argues that due to production inefficiencies, Botswana textile firms are failing to enjoy economies of scale because textile buyers abroad prefer to purchase in large volumes that Botswana firms lack the capacity to fulfil. Trimble et al.[9] identified lack of resources, people and cultural issues, poor implementation and planning, poor management commitment, poor tool and project selection, poor communication and lack of training as the key factors for productivity improvement implementation failure.

Increasing productivity is one of the most critical goals in business [10]. If the productivity improvement is carefully planned and executed, the painstaking investment is the initial cost and effort, and the reward is overwhelming results [11]. To achieve continuous productivity improvement through the utilization of improvement tools, all barriers that lead to their implementation failure have to be overcome.

III. METHODOLOGY

The research methodology adopted in the study is the descriptive survey method comprising qualitative data gathering through interviews and quantitative data gathering through survey questionnaires. The questionnaires were structured using the constructs sourced from the literature and information from experts from industry and academia within the field of productivity.

The descriptive type of research utilizes observations in the study. To illustrate the descriptive type of research, Creswell [12] guided the researcher when he stated: "Descriptive method of research is to gather information about the present existing condition".

The topics asked in the survey were related to knowledge in the use of productivity improvement tools and methodologies (PITs), and the level of application of PITs within the textile industry. The survey investigated which productivity improvement tools and management techniques were being used and their success rates, in addition to challenges faced by textile companies in applying the PITs.

The research was undertaken with the cooperation and support of a variety of textile companies in the major cities of Botswana, including Selebi-Phikwe, Lobatse, Francistown and Gaborone, who are currently involved in manufacturing all kinds of clothing including school wear, casual wear, work wear, sportswear, bedding, corporate wear, etc. The companies involved in the research were purposively selected to include micro, small, medium and large companies. The method used

to collect data was a detailed questionnaire with follow-up interviews with 7 respondents to provide additional clarity and information. The survey took the form of a self-completion questionnaire (manually and through online) completed by Company Directors, Quality Managers, Production managers, and other staff roles at senior management level in each company. The survey questionnaire consisted of questions asking for a rating on a Likert scale [13] and those asking for qualitative information. The survey questionnaire was distributed to over 60 companies in Botswana, but only 40 companies returned completed questionnaires. From the 40 companies follow up interviews were made with 7 of the companies in order to provide qualitative insights into the data collected.

IV. RESULTS

This section presents the results of the study. Out of the 60 companies targeted for the study, 40 completed the survey questionnaire, giving a response rate of 66.7 %. From the responding companies, follow up interview were made with 7 companies. The breakdown of responses, based on company size is given in Table I.

TABLE I
BREAKDOWN OF RESPONSES BY SIZE OF COMPANY

Company Category	Micro (<10)	Small (10-25)	Medium (26-100)	Large (100 +)
Number of Companies	5 (12.5%)	15 (37.5%)	10 (25%)	10 (25%)

The results are organised according to the following sections:

- A.Presents results on the knowledge that companies have on productivity improvement tools and methodologies
- B.Presents results on the use and impact of productivity improvement tools in Botswana textile industry
- C.Present results on the overall impact of the productivity improvement tools
- D.Present results on the reasons of failure (or challenges) of improvement initiatives

A. Knowledge of Tools and Methodologies

Table II provides a summary of the level of understanding that participating companies have on PITs. Results indicate that the knowledge of productivity improvement tools depends on company size. Large companies have most knowledge of PITs and understanding gradually decreases from large companies to micro companies. This finding may be explained by the fact the larger companies had been in existence for a longer time hence they had more experience in using PITs, and also had employees with relevant skills.

TABLE II
THE LEVEL OF UNDERSTANDING OF PITs

Size of company	Excellent	Good	Poor	Very Poor
Micro	0	0	4	1
Small	0	4	8	3
Medium	1	5	3	1
Large	6	4	0	0
All (n=40)	7 (17.5%)	13 (32.5%)	15 (37.5%)	5 (12.5%)

There is also evidence to suggest that small firm size is an impediment to innovation, not just because it inhibits access to technology and networks, but also because small firms may have less developed management capabilities and knowledge in productivity improvement measures and this can result in them not being as productive as large firms [14]. Also, unlike large companies, small companies have limited resources and this act as an implementation barrier. With limited resources, the smaller companies are unable to employ people with advanced skills and to seek the assistance of consultants.

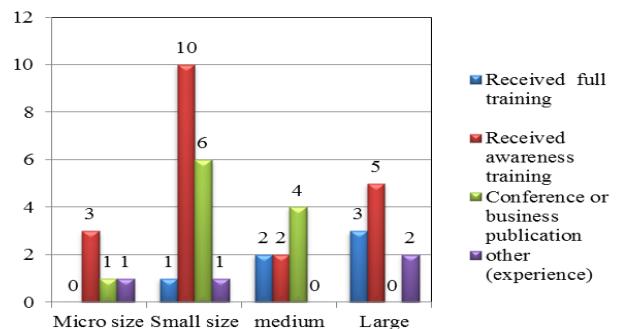


Fig. 1: How knowledge of PITs was attained (Number responding)

Fig. 1 provides a summary of how knowledge of productivity improvement tools and management methodologies was attained by the participating companies. Majority of the respondents attained the knowledge of productivity improvement tools through awareness training. The finding is not surprising since government has been providing productivity awareness training to the sector through agencies like BNPC, BOBS, and LEA, in partnership with foreign agencies. According to the Ministry of Trade and Industry report [7], government, as part of the stimulus package for the industry, released funds not only to resume textile business but also to facilitate improving textile productivity. Judging from the productivity problems still affecting the sector, this may indicate that the productivity campaign is not producing the desired results.

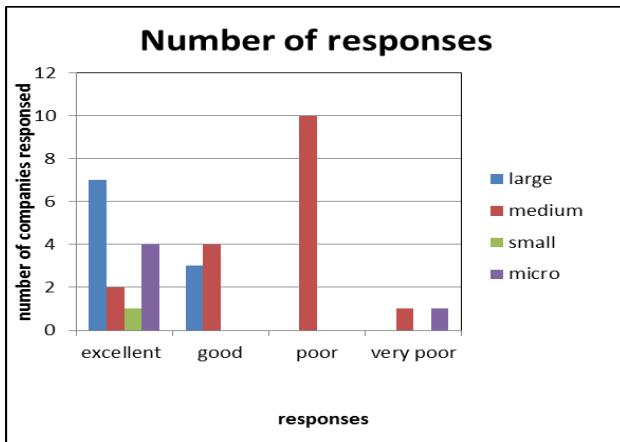


Fig. 2 Top management commitment on PITs

Fig. 2 summarises the level of commitment of top management to the use of PITs. Results indicated that there is poor top management commitment when it comes to application of PITs. Studies in the area of productivity improvement adoption indicate that top management is vital to the success of PIT's [15]. In general, top management support may include 1) sufficient resources in the form of people, time, and money for creativity and excellence to take place [16]; 2) personal involvement in PITs implementation [17].

The importance of management support for successful implementation of PITs has been well documented in the previous literature [18]. Yap and Souder [19] have found that early top management involvement can enhance the PITs' implementation success rate. Indeed, the lack of top management commitment in PITs application has been attributed to the low level of awareness among managers of the existence of these PITs, as well as their limited faith in the usefulness of these tools which result in poor tool implementation [20]. The results signify that without the strong commitment of top management, the sector has a low chance of performing well, a fact that is consistent with the findings of the studies by BEDIA on the textile sector. In this study, failure to be competitive is brought by poor implementation of productivity improvement tools, resulting in poor operational efficiencies, which leads to poor quality of products [2].

B. The use and impact of PITs in Botswana textile industry

This section discusses results on the PITs used in the participating companies and their usefulness or impact. Table III provides a list of PITs used in the Botswana textile sector together with a rating of their usefulness. The rating is as follows: 1- poorly useful, 2-less useful, 3-good, 4- Above average, 5- very useful. The table also shows the number of companies using a particular tool, number of companies who have stopped using a particular tool and number of companies who have never used a particular tool.

It is evident from table III that a large number of PITs are being used, ranging from the simplistic to the more advanced. In addition, some organisations are using a large number of

tools, i.e. more than half of the 38 tools contained within the list. One of the tools, standardized work, was found to be the most used tool, probably due to the fact that it is seen as the foundation for productivity improvement. Almost all the companies surveyed (38) use standardized work. Apart from standardised work, other popular PITs include cost benefit analysis, balanced scorecard, and Pareto analysis which are used by 80% of the surveyed companies. These most used tools have also been rated as the most useful tools, with ratings of 4 (above average) and 5 (very useful).

One interesting result is the use of Just-in-Time, where out of 17 companies who initially used it, 8 have stopped using the tool. According Pavnaskar et al, [21] Just-in-time manufacturing provides zero tolerance for mistakes, as it makes re-working very difficult in practice, as inventory is kept to a bare minimum. These companies therefore fear not being able to meet an unexpected increase in orders due to the fact that there would be no excess finished goods in storage. The companies have therefore stopped using JIT in the belief that it disadvantages their business. One of the company chief executive stated that *"In the past we used JIT, but as the market grew we stopped using it as we failed to meet the orders in time while customers were putting us under pressure wanting the goods immediately. My company increased finished goods inventory whereby we produce based on past sales demand forecast. Products with a high demand in the previous periods are projected to have a high demand in the current period and will therefore be produced to stock before orders come in"*

Again, as indicated in Table 3 companies tend to use tools that are simple and common. Companies favour to use tools which they perceive useful to them and require less resources and skills so that they do not have to release many of their workers from core business to attend to productivity improvement projects. This is well illustrated by one owner manager who commented: *"The reason why I stopped using run charts in my organisation is because they consume a lot of time drawing, and they need skilled personnel. My management team decided to turn to easy and fast tools which favour our resources since we have limited number of skilled staff who can apply complex tools effectively."*

The least used tools are affinity diagrams, force field, pokayoke, jidoka, six big losses and tree diagrams. By concentrating on simple tools only, most of these companies are avoiding tools that are rated to be the most suitable tools for the textile industry.

According to Daniels [22], some of the key productivity improvement tools being used in the textile industry include value analysis, Pareto analysis, cause-effect diagrams, cost/benefit analysis, continuous flow, Heijunka (Level Scheduling), Jidoka (Autonomation), etc, and these tools have the potential to provide long-term benefits for textile companies.

Applying only simple tools is an issue since the tools are unlikely to produce the required improvements. To increase

the probability of success, companies should identify improvement projects based on business need, and identify the most suitable PITs for the projects.

TABLE III
PITS BEING USED IN THE BOTSWANA TEXTILE INDUSTRY

Tools	Number of companies still using the tool	Number of companies stopped using the tool	Number of companies never used the tool	Rating of usefulness
5s	13	1	26	2
5 whys	8	0	32	3
Affinity diagram	2	0	38	2
Balance scorecard	34	0	6	4
Cause and effect diagram	23	0	17	3
Control charts	10	0	30	2
Correlation	2	0	38	1
Cost benefit analysis	35	1	4	5
FMEA	17	0	23	2
Force field analysis	0	0	40	-
Gant charts	19	0	21	2
Gemba walk	0	0	40	-
Histograms	21	0	19	3
Jidoka	0	0	40	-
Just in time	9	8	23	1
Kanban	2	0	38	1
Kaizen	8	0	32	2
Minitab	1	0	39	1
Pareto analysis	32	0	8	4
Performance indicators	18	0	22	2
Poka-yoke (error proofing)	1	0	39	1
Prioritization diagram	8	0	32	1
Process capability	5	1	34	1
Run charts	9	2	29	2
Scatter diagrams	6	0	34	1
SIPOC	3	0	37	1
Six big losses	0	0	40	-
SMART goals	16	0	24	3
SPC	6	0	34	1
Standard operations	22	0	18	3
Standardized work	38	0	2	4
Takt time	9	0	31	1
Total productive maintenance	21	0	19	3
Tree diagrams	0	1	39	1
Value stream mapping	15	0	25	2
Visual factory	2	0	38	1
Risk analysis	27	0	13	3
Visual management	27	0	13	3

C. Overall impact of PITs

Fig. 3 and 4 show a summary of the perception of participating companies with regards to whether they find the

tools they are using useful or not. Results indicate that only 36% of the companies (14) find the tools they implemented useful, that is, they met the desired results. Out of the 14 companies that found the tools useful, 63.6% are large companies, 9.1% are medium, 27.3% are small companies, and none of the micro companies found the implemented tools useful. Thus, all PITs initiatives implemented by micro companies did not produce the desired results (see fig. 4). These results can be explained by the fact that smaller companies lack adequate resources to implement the PITs, as already discussed in section A.

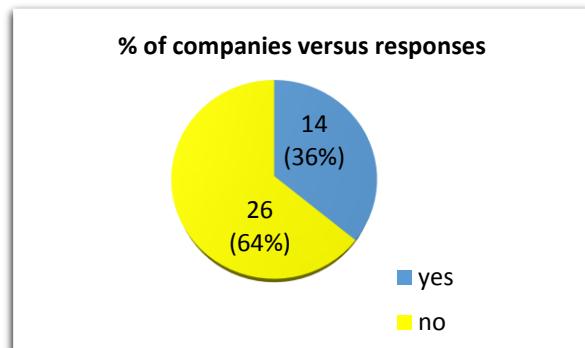
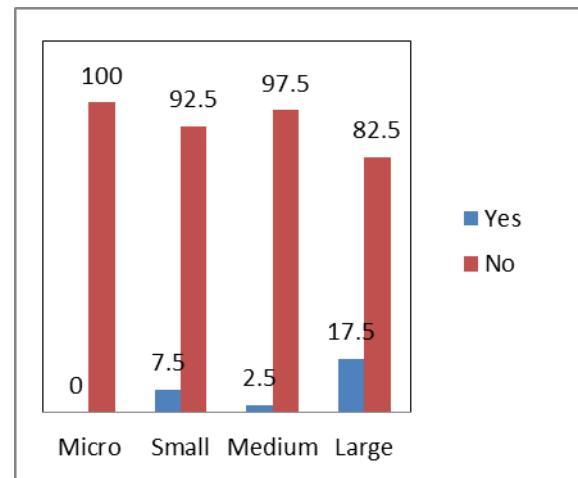


Fig. 3: Usefulness of PITs



D. Reasons for Failure (challenges)

Table 4 presents the reasons attributed to the failure of PITs initiatives by survey respondents. The reasons for failure are varied and largely agree with those identified within the literature. The results indicate that lack of resources, lack of training, poor management commitment as well as culture and commitment (which is a ripple effect of lack of training) are the most significant reasons for PITs initiatives failure. 57.5% of respondents stated that resources had been a barrier to the success of the implementation with some of the companies stating that project team members were expected to participate in projects whilst still carrying out their normal daily functions. However, the smaller sized companies were the ones most affected by lack of resources, lack of training and

poor management support, while culture and commitment affected all the different sizes of companies, with the exception of micro enterprises.

TABLE IV
REASONS FOR PITs INITIATIVES FAILURE

Main Reason for Failure	Percentage of survey respondents who stated this reason for failure				
	Micro	Small	Medium	Large	Total
Lack of resources	12.5	30	12.5	2.5	57.5
Lack of Training	5	40	5	5	55
Limiting Magnt Support	12.5	32.5	2.5	7.5	55
Culture and commitment	2.5	10	15	17.5	45
Lack of Communication	0	2.5	5	5	12.5
Poor project management	7.5	2.5	2.5	0	12.5
Poor Project Selection	0	5	15	0	20
Poor Tool Selection	10	0	0	0	10

Most of the companies stated that they struggle with resources as they have to cut their annual budgets each year due to the need to put aside funds for the repayment of the sector stimulus loan from the Botswana government. Resources in this context refer to much more than just labour as there were also many issues around budgets and the amount of investment available to support change initiatives. In addition, from the company interviews it was highlighted that lack of training is the main reason for the implementation failure. The companies also pointed out that one of the reasons why their staff lack the relevant training is that there are a few or no schools locally where they can send their employees for short courses on productivity improvement. They further stated that some of their positions remain vacant for long periods of time because they cannot find skilled manpower to fill the positions. They also highlighted high staff turnover as one of the reasons for lack of skills as employees tend to migrate to other organisations leaving them short in manpower hence rendering them to produce below their set standards. For management methodologies such as Six Sigma, the cost is too high and companies invest a considerable amount of time and money in its development. The survey found that companies investing in management methodologies thought that the investment was significant, and the use of management methodologies was considered as a key strategy that will allow them to achieve their long term aims and as such need to be resourced appropriately.

The study also found that managers released the people they could afford rather than people who would be best to support improvement projects. The fact that resources are limited highlights the need to ensure that productivity improvement initiatives are focused on issues that will have a significant impact on business performance. To do this effectively

companies need to be able to highlight the key business issues and match these with the appropriate tools and methodologies.

The success or failure of the application of productivity improvement tools or management methodologies within an organization can be judged in terms of how it meets its intended objectives. An implementation where a problem is solved or productivity improvement is made will give the tool or methodology some credibility with the users and senior management within the company, whereas a poor implementation will result in a reluctance to use the tool or methodology for future activities. Failure to achieve intended objectives may therefore explain why some companies have stopped using some PITs.

V.CONCLUSION

The findings from the research have pointed out a number of key issues which need to be addressed if real, and sustainable benefits from the application of productivity improvement tools and management methodologies are to be achieved. The research has indicated a high implementation failure rate of 64%, with most textile companies lacking knowledge and understanding on the application of productivity improvement tools. The research has also magnified the consequences of poor implementation and inappropriate selection of productivity improvement tools, as well as poor selection of productivity improvement projects.

In essence, it would appear that a number of textile companies are potentially wasting valuable and scarce resources and effort by implementing a range of productivity improvement tools which are failing to deliver the results expected. A number of related factors would appear to be contributing to this position:

1. The relatively low level of understanding of productivity improvement tools and management methodologies.
2. The relatively low level of training received in the use and application of productivity improvement tools and management methodologies.
3. A lack of a strategic approach to the application of tools and techniques as a result of tools and techniques being selected before a clear business need has been identified. This can result in two possible areas of potential misalignment, namely: (i) Tool/methodology misalignment where an inappropriate tool/methodology is applied to solve a particular problem, and (ii) Deployment misalignment where a fundamental assessment of a company's performance has not been undertaken to identify and prioritize the business areas which would benefit from improvement. Failure to do this may result in resources being deployed, and improvements being made in areas which do not improve overall business performance [9]. The result is disillusionment with the tools and failure to recoup benefits from the investment on the improvement initiatives.

A strategic approach in the adoption and application of PITs within the textile sector is therefore required to address issues

raised in this study if the benefits of productivity improvement tools are to be realized.

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